for ten minutes I hurried to the nest area where several birds were whistling the challenge song.

There were two males and a female together in a York gum near where the past bowing display had been performed. All three birds were whistling. First, a short bubbling call was repeated several times—begun by a male and finished by the female. It was so neatly done that if I hadn't found the observation confirmed each time, if I hadn't seen her attitude and swelling throat, I would have believed the male alone sang it. Then the three birds began a competitive whistling with beaks but a few inches distant from each other. This time the female's song was definitely independent, a vigorous and virile challenge like the males'. There was no elaborate bowing as formerly though the bodies were tense and feathers extended.

Having noted the young male's plumage just prior to this as being still slightly different from a female's I had no doubt of this Whistler's sex. When she became aware of me she more definitely identified herself as the shy original female, by hastily flying towards the nest, dodging behind a tree and hiding herself. The original male continued the challenging song with the intruder who later left the tree and joined his mate who was nearby feeding and preening. These two then withdrew along a line of trees to the west.

PHENOLOGY—A NEW FIELD FOR AUSTRALIAN NATURALISTS

By J. GENTILLI, Nedlands.

Anyone familiar with that triumphant awakening of nature that is the nordic spring can easily understand why springtime means so much to the British, the Germans, and above all the Scandinavians. The longer has Nature's winter sleep lasted, the fuller and more overwhelming will the awakening be in spring. It is perhaps unusual to refer to music in scientific writing, but it should be mentioned here that the expression of springtime feelings and longings is perhaps most effectively embodied in Sinding's popular "Rustle of Spring"—a composition inspired by springtime in Norway.

It was only to be expected that the first appearance of snowdrops or yellow crocus in the melting snow, the arrival of the swallows with the first sunny warmth, the first song of the cuckoo, should win the friendly interest of so many people. This interest did not wane with the development of scientific knowledge, and on the contrary took a new form, with accurate observing and recording—thus Phenology came into being.

Phenological observations have been made for many years in several European countries, but especially in Germany and Britain. While recent phenological material from Germany has not been received as yet, the 1946-47 British phenological report—57th of a series—was issued in 1948.

It is a booklet of 32 pages, full of tables and diagrams. A brief survey of its contents will best describe the field of Phenology. The opening section deals with the year's weather and climate, and the effects on wild life, such as the mortality among birds and the scarcity of moths and butterflies because of the intense winter cold. Accurate tables give the date of first 1947 flowering for 14 plant species in over 200 localities. Similar information is given for 15 additional plant species. The dates of total loss of leaves in 1946 and first leafing in 1947 are given for five species of trees. The first record of frog spawn is entered for about 60 localities. The dates of arrival of the swallow, the first songs of the cuckoo, nightingale, nightjar, and song thrush are recorded for 1947 in two localities as part of a series of observations that goes back to 1736. The last autumn record and the first spring record are given for seven bird species together with the date of the first spring song for four species, for over 200 localities. The diagrams repeat the same basic information in graphic form.

The publication closes with tables of temperature, rainfall and sunshine for every week of the year and for every regional area, as collected and computed by the Meteorological Office.

A comparatively late start may have some advantages in that the organization of the network is free from too much tradition, and use can be made of experience in other countries. An excellent example is offered by Spain, where the Servicio Meteorologico Nacional began phenological records in 1943. Year after year twin publications have been issued, a meteoro-phenological calendar distributed to each observer at the beginning of the year, and a booklet of meteoro-phenological records compiled after the year's work is ended.

The meteoro-phenological calendar for 1949 is a booklet of 164 pages, which begins with a form to be filled in by the observer, with his name, address, postal address, height, aspect etc. of the locality where observations are made. There follow civil and astronomical calendars, with information on twilight, sunrise and sunset.

Each observer receives forms and postcards specially printed to suit his requirements as phenological observer, and the use to be made of this material is clearly explained on the forms themselves and in the calendar, which could be taken as a model when it requires observers to: 1. Read all directions accurately before making any notes on forms, cards or calendar. 2. Mark the exact date when any particular fact took place, avoiding vague dates, "middle of the month," "first week," etc. 3. Return the annual forms and the cards, keeping the calendar. 4. Keep correspondence to a minimum. 5. Train somebody else as a substitute observer. 6. Pass all the material to the substitute observer whenever unable to carry on the work for any reason or length of time. 7. Should it be definitely impossible for an observer to continue his work, he should personally arrange for continuation of the work by someone else, so that there be no interruption in the records. 8. The development of plants must be followed daily and

entries should be made in the calendar for the dates of appearance of first leaves, first flowers, ripening of the fruit, fall of leaves, etc. These entries should then be copied on to the cards and the forms. The cards should be sent every month normally, and at any time in case of urgent matters. Observers should record the month and day of each development exactly for each plant listed. They should always rely on personal observations only. Should it be impossible to follow several species of plants at the same time, some should be selected, preferably always the same.

The plants to be observed should be wild plants, except in the case of specified crops. They should grow normally in their normal habitats. Observations should rely on many individuals of the same species, because Phenology aims at recording the general conditions of development, disregarding accidental events. It is not a case of recording the appearance of the first flower on one individual plant alone; several plants of the same species should begin to flower before the fact were recorded. When plants are not common the fact should be mentioned. Healthy and well-established plants should be watched in preference to young or freshly-planted ones. In the case of cultivated plants, the same varieties should always be studied, and mention of them should be clearly made in the records. Observations should be limited to a radius of about 6 miles from the observer's home. First flowers should be noticed on several individual plants and their stamens or pistils should be visible before they are recorded. General flowering means that at least half the flowers have opened on each plant. As to fruits, they should be ripe on several individual plants, and some of them should be easily detached (if juicy) or should burst spontaneously (if dry).

As to crops, observers should note the dates of seeding or planting, formation of the ear, harvesting, and also of the appearance of diseases, weeds, of losses through hail, frost, flood, drought, etc.

There follows a list of 32 species of wild plants, 13 of crops, 11 of fruit trees, four migrant birds to be observed arriving or departing, two birds to be heard, two insects to be first seen. Coloured plates of the plants listed are sent free to each observer. The calendar includes original maps with the flowering date of the almond tree, the date of loss of leaves on the vine, the dates of arrival of the swallow and the stork, all for the year 1948. The various meteorological and climatological aspects of the work are described in the remainder of the calendar, with details as to the normal weather for each month, the weather for the previous year, information for meteorological observers, etc.

With suitable changes, many of the features of the meteorophenological calendar could be adopted by the Australian Meterological Service, when it will be able to begin phenological work. The free distribution of a useful calendar and of specially prepared forms and cards seems an almost necessary feature of a successful scheme. The last booklet of phenological records published

in Spain lists over 300 voluntary observers, giving full name and address of each one—and this number is the best proof of the success with which Phenology has met in that country.

Australian naturalists do witness the awakening of Nature, not after its winter sleep, but after long seasonal droughts. The awakening is none the less spectacular, and the arrival of birds from nowhere and the sudden spread of a carpet of flowers are unique features of the Australian natural setting. However, there are no exact records of what takes place.

A few examples may suffice. The Willy Wagtail has two distinct calls—a chirping sound which is often associated with driving invaders from its territory, and a proper song. The song is usually heard in winter, and is by many people thought to announce rain. Some ornithologists, however, think it is only connected with breeding activities. The following song observations were made by the writer in December 1948, in the Nedlands-Dalkeith area, and are here correlated with humidity data kindly supplied by the Climate Section of the Perth Weather Bureau:—

Date	Song	Relative humidity 9 a.m.	Date	Song	Relative humidity 9 a.m.
Dec. 2	—	45	Dec. 13	isolated	44
3	isolated	50	14	isolated	49
4	widespread	58	15	isolated	48
5	isolated	57	16	widespread	54
6	—	44	17	isolated	59
7	—	29	18	isolated	43
8	—	48	19	isolated	41
9	—	44	20	—	74
10	—	44	21	isolated	62
11	isolated	62	22	—	62
12	general	69	23	widespread	61

The observations show that rainfall is not a factor in determining the song, because no rain was recorded at the time. They show that the singing may be confined to single birds or to several birds calling and answering, or may be extended to practically the whole bird population, as on December 12. There was no recorded song for a 5-day period from December 6 to December 10, when the relative humidity fell below 50 per cent. and reached an exceptional low of 29 per cent. on the 7. The most humid days corresponded to widespread singing, with some notable exceptions on December 20 and 22. Was it the observer's fault? It is quite possible that, owing to various reasons, the observing may have been less accurate towards the end of the period in question. Also, there may have been no birds in the vicinity at the time. According to Sedgwick, there might be some breeding activity in December associated with the fourth clutch of eggs, but this is considered exceptional. Even so, why should the birds sing at selected times only? Thus the problem is not solved as yet—what makes the wagtail sing? Obviously a team of observers who

kept written records could solve the problem, tentatively at least, in about a year.

Another "rain-bird" is the Pallid Cuckoo. It migrates south about May, and thus is often heard with the first rains. The writer's observations failed to disclose any correlation between Pallid Cuckoo song and rainfall, but a much more vital question took shape during these observations—when, or why, does the Pallid Cuckoo move south? And how far north does it go when it leaves in summer? There is a clear relationship between the first rains and the arrival of the bird, but what amount of rain should fall before the bird arrives? How does the Pallid Cuckoo living in Northern Australia know when sufficient rain has fallen in the South-west? Or are its movements controlled by the declining length of day, so that when days begin to shorten noticeably the bird feels an urge to move towards the "darker South"? Or is it simply that Northern Australia is totally parched by April or May, so that the cuckoo has to leave if it wants to breed at all?

Here again, only a large team of observers may hope to find an answer. Not only, but these observers must afford a good geographical "coverage" of the area inhabited by the Pallid Cuckoo, both north and south. Without some co-ordination of records in both Northern and Southern Australia arrivals and departures may remain as isolated records without much significance.

It is obvious that there is little hope of accurate recording in this field without accurate geographical planning. The urgent need for accurate recording of localities, so aptly stressed by McGill in *The Emu*, is even more necessary here.

With these problems in mind, the writer raised the whole question of phenological observations in Australia before the 1948 Congress in Perth of the Royal Australasian Ornithologists' Union, and the suggestion was readily adopted. The Union felt that a thorough study should be made of very few widespread species at first, and the Pallid Cuckoo, the Black-faced Cuckoo-shrike and the Rainbow-bird were selected. The reasons for the choice were the widespread distribution and easy identification of these birds and the gaps in our knowledge of their distribution and movements. The writer's view is that observers should limit their study to the birds concerned—and any other animals they may come across or wish to study—without worrying about weather and climate if there is a meteorological station anywhere in the district. Rainfall and temperature data, and often cloudiness and humidity data as well, may be obtained from the person in charge of the station in a few minutes, and are more likely to be accurate. To read a rain-gauge daily is an unpleasant task during the wet season, and to expose a thermometer correctly is one of the most difficult achievements in meteorology. Humidity data are usually out of the question for the layman without the necessary instruments; furthermore guesswork may be extremely misleading. For all these reasons the writer feels that observations should be confined to the nature study aspects, leaving meteorology and climatology to the respective experts. This is the course adopted by the Phenological Executive Committee in Britain, where pheno-

logical work is carried out under the auspices of the Royal Meteorological Society.

The central collection of data on the three birds selected has been entrusted to the Editor of *Wild Life* (Mr. Crosbie Morrison), because of the widespread distribution of that journal and of his extensive network of radio talks. Some details on the birds, with photographs, are published in the May 1949 issue. Any intending observers should carefully read these details and look for the three species of birds throughout the year. Progress results should be sent to the Editor of *Wild Life,* 44-74 Flinders Street, Melbourne, as soon as they are available. They might be very brief, such as "Pallid Cuckoo, first heard calling at . . . (locality) on . . . (date, and hour of the day if available)."

Notes on other species and queries concerning more particular Western Australian problems may be addressed to the Hon. Secretary of the Western Australian Naturalists' Club, which is co-operating with the local Meteorological Bureau in its proposed programme of phenological observations.

The most urgent problem is the investigation of dates of arrival and departure of migrant species, the beginning of nesting activities, the first dates of appearance of insects, the first dates of flowering of plants. It should be borne in mind that most phenological research has been carried out in Europe and North America, continents where cold and to a certain extent darkness are the limiting factors. Moisture is the controlling factor in Australia, and this difference makes Australian research more original and stimulating—and more difficult.

Only teamwork can do it—and it must be the work of a very large team, in which country teachers and children can play a very important role. The recording of the exact dates of all these events may become part of the school's activities, and may become a feature which continues from year to year. Every country resident can add a little to this great weave which may in the long run reveal some of the great mysteries of Nature.

It is an ambitious plan, but it cannot fail because it rests upon everyone's patient and pleasing observations. And the pleasure felt far outweighs the patience required.

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